

HIV Pre-exposure Prophylaxis (PrEP) Uptake Among Gay and Bisexual Men in Australia and Factors Associated With the Nonuse of PrEP Among Eligible Men: Results From a Prospective Cohort Study

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Background: HIV pre-exposure prophylaxis (PrEP) is a highly effective biomedical HIV prevention strategy, yet some gay and bisexual men (GBM) who are eligible to access PrEP are not using it. We report the incidence of PrEP uptake, factors predicting its initiation, and identify characteristics associated with nonuptake of PrEP among Australian GBM who meet the eligibility criteria.

Methods: The Following Lives Undergoing Change (Flux) Study is a national, online, prospective observational study among GBM focusing on licit and illicit drug use. Participants (N = 1257) responded to baseline and 6-monthly follow-up questionnaires. Incidence per 100 person-years and incidence rate ratios of PrEP initiation are presented. Multivariate Poisson regression was used to examine associations with PrEP initiation and logistic regression to examine associations with nonuptake of PrEP among eligible GBM.

Results: Among GBM who met the eligibility criteria, 69.8% of men did not commence PrEP. Factors independently associated with nonuptake of PrEP were younger age, living in an Australian state without a PrEP trial, lower social engagement with other gay men,

less use of illicit party drugs or use of illicit party drugs for sex, and less likely to have engaged in HIV sexual risk behaviors such as group sex or any condomless anal intercourse.

Conclusions: Despite meeting formal eligibility criteria for PrEP, men who were relatively less sexually active or less socially connected were less likely to initiate PrEP. Men who did not initiate PrEP may assess their risk as insufficient relative to others to warrant using PrEP because they engaged in less frequent “risky” behaviors.

Key Words: eligible, gay bisexual men, HIV, incidence, PrEP, prevention

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INTRODUCTION

In Australia, gay and bisexual men (GBM) account for the majority (~70%) of new HIV diagnoses.¹ Over the past 10 years, there has been a 21.0% decrease in HIV notifications among Australian born GBM.¹ However, among notifications due to male-to-male sexual contact, the proportion who were Asian born GBM increased from 28.0% in 2008 to 52.0% in 2017 but remained stable among GBM from other countries.¹ Despite increasing levels of HIV testing, and higher and earlier treatment coverage among those diagnosed with HIV,² new HIV diagnoses in Australia were stable in the decade to 2017.¹

The coformulation of tenofovir disoproxil fumarate and emtricitabine (FTC) as pre-exposure prophylaxis (PrEP) is a highly effective biomedical HIV prevention strategy.^{3,4} Australia’s National HIV Strategy prioritizes GBM for HIV prevention, and PrEP has recently been approved for public subsidy in Australia, ensuring that individuals at high risk of HIV have affordable access.^{5,6} Before this, several Australian jurisdictions made PrEP available to high-risk individuals through large-scale implementation studies^{7–9}; substantial reductions in HIV diagnoses have since been described in New South Wales.^{6,10,11}

The national eligibility criteria for access to PrEP for GBM include at least 1 episode of any of the following in the previous 3 months: condomless anal intercourse (CAI)

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with an HIV-positive regular partner not on treatment or with detectable viral load; receptive CAI with a casual partner (R-CAIC); diagnosis of a rectal sexually transmitted infection or infectious syphilis; or methamphetamine use. Cross-sectional surveys have shown that most men who have commenced PrEP meet prescribing guidelines.¹² GBM who meet these criteria, herein described as “PrEP-eligible,” are at highest risk of HIV seroconversion.^{13–15}

Australian behavioral surveillance finds that PrEP use increased from 2% to 24% among HIV-negative GBM between 2013 and 2017.¹⁶ During the same period, among men who were HIV negative or untested and not on PrEP, the proportion who reported having engaged in R-CAIC remained steady at 19.6%.

Although PrEP use has rapidly increased among Australian GBM and financial barriers have been reduced within the Australian health system by recent public subsidy, many PrEP-eligible men are not accessing it.¹⁶ To date, there have been limited data on community-based cohort studies that examine PrEP uptake in individual GBM,¹⁷ none of which assessed uptake against PrEP eligibility criteria. Little is known about the influence of social, community, and interpersonal factors on initiation.

In this paper, we use data from a prospective observational cohort of GBM in Australia to:

- Estimate incidence of uptake and factors predicting PrEP initiation, and
- Identify factors associated with the nonuptake of PrEP among PrEP-eligible men.

METHODS

Study Design and Procedure

The Following Lives Undergoing Change (Flux) Study is an ongoing national, online, prospective observational study among GBM to examine the prevalence, incidence, and contexts of licit and illicit drug use. The primary aim of Flux was to identify individual and contextual factors associated with initiation of licit and illicit drug use and changes over time in patterns of sexual and drug use behaviors among GBM. The study protocol has been published previously.¹⁸

Participants

Men were eligible to participate in the study if they were at least 16 years and 6 months of age; identified as gay or bisexual, or had sex with a man in the past 12 months; and lived in Australia. Use of licit or illicit drugs or knowledge about PrEP was not requirements for participation. Participants were recruited between September 25, 2014, and July 5, 2015, through Facebook, gay community websites and online media, mobile phone applications, and gay sexual networking websites. At enrolment, online informed consent was obtained from all participants. No compensation was offered for participation in this study.

Procedures

Baseline and 6-monthly follow-up questionnaires were completed online using computer-assisted self-interviewing software.¹⁸ Demographic items included country of birth, ethnicity, state of residence, education, and employment status. Social engagement with gay men was assessed using a scale with 2 items (proportion of friends who are gay men and amount of free time spent with gay male friends), where higher scores indicated greater social engagement with gay men.¹⁹ HIV status was self-reported. HIV-negative/untested men reported use of PrEP (“daily, every other day, or before and after sex”). Men reported their use of methamphetamine and their sexual behavior in the previous 6 months. Three categories of sex partners were included: “boyfriends” (a regular committed partner with whom they maintained a romantic relationship); “fuckbuddies” (nonromantic regular partners); and casual partners.²⁰ GBM who reported a regular committed partner were also asked about their partner’s HIV serostatus and, if HIV positive, whether they were on treatment.

Statistical Analysis

Data were right-censored to account for participants who left the study before PrEP initiation or did not provide any follow-up data. Right censoring allows for all accrued follow-up time to be included in the analysis but acknowledges that the “time to event,” in this case, PrEP initiation, may not occur for some individuals.²¹ Analyses included all men who completed at least 1 follow-up questionnaire, reported an HIV-negative/unknown serostatus, and reported no PrEP use at baseline. Participants with missing data included in this analysis were noted accordingly and included in the denominator. Baseline characteristics were summarized by PrEP eligibility and initiation status. Analyses focused on the following factors: demographic and behavioral characteristics reported at preceding follow-up questionnaires associated with subsequent PrEP initiation; and factors associated with the nonuse of PrEP among PrEP-eligible men over a 24-month period. PrEP initiation was defined as the first 6-month period of PrEP use following a baseline report of no PrEP use.

Based on the Australian PrEP prescribing guidelines,¹⁵ PrEP eligibility for this sample was defined as any CAI with a regular HIV-positive partner not on treatment or with detectable viral load; any R-CAIC of HIV-positive or unknown status; any methamphetamine use; or rectal gonorrhoea, rectal chlamydia, or infectious syphilis diagnosis in the past 6 months. The clinical guidelines use a 3-month period because most data collected in Australian clinic settings are for that time period.¹⁵ However, the Health in Men study on which the guidelines were based used a 6-month time period,¹³ as is commonly reported in behavioral research.²² The Flux Study used measures that were drawn from the Health in Men study and hence also used a 6-month time period. The level of HIV risk for sexual behavior in this study was categorized using a previously used classification system, ranging from lowest risk to highest risk (no such partner, no

anal sex with this type of partner, consistent condom use, insertive-only CAI, and any R-CAIC).¹²

To determine what factors were associated with the initiation of PrEP, time-varying variables reported in the previous questionnaire were considered as predictors for PrEP initiation. Bivariate Poisson regression was used to examine the associations between PrEP initiation, and incidence rate ratios per 100 person-years (100 PY) and their corresponding 95% confidence intervals (CIs) were presented. Predictors with a *P* value <0.10 in bivariate analyses were included in multivariable analyses.

Multivariable Poisson regression models were then constructed to allow adjustment for confounding factors. Multivariate associations with a *P* value of <0.05 were retained in the final model. To estimate statistical associations of PrEP-eligible men who did not initiate PrEP, bivariate regression was used to examine the associations between noninitiators and their PrEP-using counterparts. Odds ratios (ORs) and their corresponding 95% CI were presented. Predictors with a *P* value <0.10 in bivariate analyses were included in the multivariable analyses.

Binary logistic backward stepwise multiple regression analysis was used to control for confounding factors and presented as adjusted ORs (aORs) and 95% CI. Multivariate associations with a *P* value of <0.05 were retained in the final model. The year of study visit and state of residence were included in both models to account for increasing availability of PrEP over time, and differential availability of, and information about PrEP in different Australian states and territories. Data were analyzed using Stata version 15 (StataCorp, TX).

RESULTS

Overall, 1695 men were enrolled during 2014–2015, of whom 1377 (81.2%) provided the minimum data required for follow-up. Men who reported an HIV-positive serostatus (*n* = 134; 7.9%) or any PrEP use (*n* = 16; 0.9%) at baseline were excluded from analysis. The following analyses were restricted to the remaining 1257 men who were HIV negative or untested at baseline.

At baseline, the mean age of the sample was 33.6 years (SD 12.3). Participants predominantly identified as gay (90.4%) or bisexual (7.2%) and most (84.6%) had been tested for HIV in the previous 6 months. Most (83.6%) reported having tested HIV negative, with 16.4% not knowing or being unsure of their HIV status. The majority of men in the sample were of Anglo-Celtic background (76.0%), university educated (58.9%), and in full-time (58.3%) or part-time (12.9%) employment. One in 4 (27.6%) reported that most of their friends were gay, and 19.7% spent most of their free time with gay friends (Table 1).

Most (91.3%) reported sex with a man in the previous 6 months, and 41.5% reported having more than 10 male sex partners in the previous 6 months. One in 5 (20.0%) had engaged in group sex in the previous 6 months. Two-fifths (37.9%) indicated they had a regular partner (or “boyfriend”), 36.6% reported sex with a fuckbuddy, and more than half

(63.3%) reported sex with casual partners in the previous 6 months. In the previous 6 months, 15.3% used drugs to enhance their sexual experiences. Most (84.4%) lived in an Australian state where a large PrEP trial had commenced before 2017.

Prevalence of PrEP Use

Within the total sample of 1257 men who reported never having used PrEP at baseline, the proportion of men who reported current use of PrEP increased from 0.0% to 18.0% at 24 months (*P* trend <0.001). A total of 226 initiated PrEP during follow-up. Thirty-two men (2.5%) initiated by 6 months and an additional 2.6% (*n* = 33), 4.0% (*n* = 50), and 8.8% (*n* = 111) by 12, 18, and 24 months, respectively. The overall incidence of PrEP use within the whole sample was 11.57 per 100 PY (95% CI: 10.00 to 13.40). Over the 24 months of follow-up, 20 men (3.6%) discontinued PrEP use after having previously initiated it after baseline. Overall, 8.8% of GBM did not meet the eligibility criteria but nonetheless initiated PrEP, and 9.5% of GBM met the eligibility criteria and initiated PrEP.

Predictors and Incidence of PrEP Initiation

In bivariate analysis, the incidence of initiation was higher among GBM who were older. Among men aged 16–24 years, the incidence of initiation was 9.0 per 100 PY (95% CI: 6.51 to 12.61). This increased to 25.88 per 100 PY (95% CI: 10.72 to 70) among men aged 40 years and older (*P* trend <0.01).

The incidence of initiation was higher among men who lived in a state where a large-scale PrEP project had commenced before 2017 (12.7 per 100 PY; 95% CI: 10.9 to 14.9) compared with GBM not living in other jurisdictions (7.0 per 100 PY; 95% CI: 4.7 to 10.9) (*P* trend = 0.012) (Table 2).

The incidence of PrEP initiation among those who did not use any illicit party drugs in the previous 6 months was 8.82 per 100 PY (95% CI: 6.9 to 11.2). Among those who reported using any illicit party drugs in the previous 6 months, but not for sex, the incidence of initiation was 9.52 per 100 PY (95% CI: 7.3 to 12.5), and among those who used any illicit party drugs specifically for sex, it was 25.45 per 100 PY (95% CI: 19.7 to 32.9) (*P* trend <0.001).

The incidence rate of PrEP initiation was higher among men who engaged in group sex (23.07 per 100 PY; 95% CI: 18.9 to 28.1) compared with GBM who did not engage in group sex (7.12 per 100 PY; 95% CI: 0.5 to 0.9) (*P* <0.001).

For those who reported insertive-only CAI with a fuckbuddy, the incidence rate for PrEP initiation was 21.60 per 100 PY (95% CI: 13.0 to 35.8) but was 35.9 per 100 PY (95% CI: 27.9 to 46.3) among those who reported receptive CAI with a fuckbuddy (*P* trend <0.001).

In multivariable analysis, PrEP initiation was more likely in more recent years. The incidence of PrEP initiation increased from 2.06 per 100 PY (95% CI: 1.08 to 3.90) in 2016 to 7.24 (95% CI: 3.97 to 13.19) per 100 PY in 2017 (*P* trend <0.001).

TABLE 1. Baseline Characteristics Comparing Eligible and Noneligible Men and Their PrEP Initiation Status (N = 1257)

N (%)	Did Not Meet the Eligibility criteria*		Met the Eligibility Criteria*		Total, 1257
	Did Not Initiate PrEP	Initiated PrEP After Baseline	Did Not Initiate PrEP	Initiated PrEP After Baseline	
	788 (62.7)	110 (8.8)	243 (19.3)	116 (9.2)	
Age					
16–24	238 (30.2)	21 (19.1)	76 (31.3)	18 (15.5)	353 (28.1)
25–29	148 (18.8)	21 (19.1)	45 (18.5)	20 (17.2)	234 (18.6)
30–39	191 (24.2)	37 (33.6)	61 (25.1)	32 (27.6)	321 (25.5)
40–84	211 (26.8)	31 (28.2)	61 (25.1)	46 (39.7)	349 (27.8)
Country of birth					
Australia	649 (82.4)	90 (81.8)	197 (81.1)	92 (79.3)	1028 (81.8)
Oceania (excl. Australia)	21 (2.7)	1 (0.9)	13 (5.3)	2 (1.7)	37 (2.9)
Asia	28 (3.6)	4 (3.6)	3 (1.2)	8 (6.9)	43 (3.4)
North America	18 (2.3)	1 (0.9)	5 (2.1)	2 (1.7)	26 (2.1)
South/Central America	2 (0.3)	0 (0.0)	0 (0.0)	2 (1.7)	4 (0.3)
Europe	45 (5.7)	8 (7.3)	13 (5.3)	10 (8.6)	76 (6.0)
Middle East	2 (0.3)	1 (0.9)	0 (0.0)	0 (0.0)	3 (0.2)
Africa	6 (0.8)	1 (0.9)	4 (1.6)	0 (0.0)	11 (0.9)
Did not answer	17 (2.2)	4 (3.6)	8 (3.3)	0 (0.0)	29 (2.3)
Ethnicity					
Anglo-Celtic	595 (75.5)	77 (70.0)	195 (80.2)	94 (81.0)	961 (76.5)
Aboriginal or Torres Strait Islander	20 (2.5)	1 (0.9)	3 (1.2)	3 (2.6)	27 (2.1)
Others	173 (22.0)	32 (29.1)	45 (18.5)	19 (16.4)	269 (21.4)
State of residence					
New South Wales and ACT	341 (43.3)	62 (56.4)	95 (39.1)	64 (55.2)	562 (44.7)
Victoria	182 (23.1)	24 (21.8)	67 (27.6)	28 (24.1)	301 (23.9)
Queensland	127 (16.1)	17 (15.5)	39 (16.0)	15 (12.9)	198 (15.8)
Others	138 (17.5)	7 (6.4)	42 (17.3)	9 (7.8)	196 (15.6)
Education					
Less than university educated	320 (40.6)	34 (30.9)	120 (49.4)	43 (37.1)	517 (41.1)
University educated	468 (59.4)	76 (69.1)	123 (50.6)	73 (62.9)	740 (58.9)
Employment status					
Not in employment	236 (29.9)	27 (24.5)	57 (23.5)	32 (27.6)	352 (28.0)
Part-time employed	96 (12.2)	15 (13.6)	40 (16.5)	11 (9.5)	162 (12.9)
Full-time employed	456 (57.9)	68 (61.8)	146 (60.1)	73 (62.9)	743 (59.1)
Socially engaged with other gay men	3.43 (1.55)	4.00 (1.67)	3.54 (1.65)	4.44 (1.53)	3.58 (1.60)
Not at all	67 (8.5)	6 (5.5)	24 (9.9)	6 (5.2)	103 (8.2)
A little	321 (40.9)	29.1	89 (36.6)	21 (18.1)	463 (36.9)
Mostly	202 (25.7)	22 (20.0)	55 (22.6)	27 (23.3)	306 (24.4)
Very much	195 (24.8)	50 (45.5)	75 (30.9)	62 (53.4)	382 (30.5)
Methamphetamine use					
No recent use (including never used)	788 (100.0)	110 (100.0)	115 (47.3)	59 (50.9)	1072 (85.3)
Recent use	0 (0.0)	0 (0.0)	128 (52.7)	57 (49.1)	185 (14.7)
Reasons for party drug use					
No recent drug use (including never used)	677 (85.9)	80 (72.7)	97 (39.9)	46 (39.7)	900 (71.6)
Recent drug use (not for sex)	69 (8.8)	16 (14.5)	60 (24.7)	20 (17.2)	165 (13.1)
Recent drug use (used to enhance sex)	42 (5.3)	14 (12.7)	86 (35.4)	50 (43.1)	192 (15.3)
No. of recent sex partners					
No sex partners	98 (12.4)	9 (8.2)	2 (0.8)	0 (0.0)	109 (8.7)
1 sex partner	229 (29.1)	14 (12.7)	20 (8.2)	2 (1.7)	265 (21.1)
Up to 10	325 (41.2)	42 (38.2)	121 (49.8)	38 (32.8)	526 (41.8)
Up to 50	124 (15.7)	40 (36.4)	94 (38.7)	64 (55.2)	322 (25.6)
More than 50	12 (1.5)	5 (4.5)	6 (2.5)	12 (10.3)	35 (2.8)
Group sex					
No group sex	671 (85.2)	78 (70.9)	190 (78.2)	67 (57.8)	1006 (80.0)
Recent group sex	117 (14.8)	32 (29.1)	53 (21.8)	49 (42.2)	251 (20.0)

TABLE 1. (Continued) Baseline Characteristics Comparing Eligible and Noneligible Men and Their PrEP Initiation Status (N = 1257)

N (%)	Did Not Meet the Eligibility criteria*		Met the Eligibility Criteria*		Total, 1257
	Did Not Initiate PrEP	Initiated PrEP After Baseline	Did Not Initiate PrEP	Initiated PrEP After Baseline	
	788 (62.7)	110 (8.8)	243 (19.3)	116 (9.2)	
Sex with a casual partner					
No casual partner	393 (49.9)	29 (26.4)	33 (13.6)	6 (5.2)	461 (36.7)
No anal intercourse	113 (14.3)	30 (27.3)	20 (8.2)	7 (6.0)	170 (13.5)
Consistent condom use	205 (26.0)	31 (28.2)	19 (7.8)	12 (10.3)	267 (21.2)
Insertive-only condomless anal intercourse	61 (7.7)	15 (13.6)	22 (9.1)	8 (6.9)	106 (8.4)
Receptive condomless anal intercourse	0 (0.0)	0 (0.0)	148 (60.9)	82 (70.7)	230 (18.3)
Did not answer	16 (2.0)	5 (4.5)	1 (0.4)	1 (0.9)	23 (1.8)
Sex with fuckbuddies					
No fuckbuddies	557 (70.7)	65 (59.1)	131 (53.9)	44 (37.9)	797 (63.4)
No anal intercourse	49 (6.2)	10 (9.1)	12 (4.9)	8 (6.9)	79 (6.3)
Consistent condom use	69 (8.8)	8 (7.3)	13 (5.3)	5 (4.3)	95 (7.6)
Insertive-only condomless anal intercourse	38 (4.8)	6 (5.5)	12 (4.9)	9 (7.8)	65 (5.2)
Receptive condomless anal intercourse	66 (8.4)	20 (18.2)	75 (30.9)	50 (43.1)	211 (16.8)
Did not answer	9 (1.1)	1 (0.9)	0 (0.0)	0 (0.0)	10 (0.8)
Sex with boyfriend					
No boyfriend	475 (60.3)	62 (56.4)	162 (66.7)	81 (69.8)	780 (62.1)
No anal intercourse	28 (3.6)	4 (3.6)	4 (1.6)	1 (0.9)	37 (2.9)
Consistent condom use	46 (5.8)	3 (2.7)	7 (2.9)	1 (0.9)	57 (4.5)
Any condomless anal intercourse with an HIV-negative partner or an HIV-positive partner with an unknown, undetectable serostatus, or is on treatment	236 (29.9)	41 (37.3)	69 (28.4)	32 (27.6)	378 (30.1)
Any condomless anal intercourse with an HIV-positive partner (detectable viral load or not on treatment)	0 (0.0)	0 (0.0)	1 (0.4)	1 (0.9)	2 (0.2)
Did not answer	3 (0.4)	0 (0.0)	0 (0.0)	0 (0.0)	3 (0.2)

*Percentages represent total in column. ACT, The Australian Capital Territory.

The incidence of initiation was higher among those who were socially engaged with other gay men (2.12 per 100 PY; 95% CI: 0.86 to 5.20) compared with GBM who had no, or little social engagement with other gays (P trend <0.001).

The incidence of initiation was higher among men who had recently used methamphetamine (1.50 per 100 PY; 95% CI: 1.10 to 2.05) compared with men who had never used or reported no recent use (P trend <0.001).

PrEP initiation was also associated with having a higher number of sexual partners. Compared with GBM who had 1 sex partner in the previous 6 months, GBM who had up to 10 sexual partners in the previous 6 months had a PrEP incidence rate of 3.78 per 100 PY (95% CI: 2.75 to 22.73). The incidence rate increased to 7.91 per 100 PY (95% CI: 2.75 to 22.73) and 8.03 per 100 PY (95% CI: 2.40 to 26.87) when GBM had up to 50 and over 50 sexual partners in the previous 6 months, respectively (P trend <0.001).

Among GBM who engaged in insertive-only CAI with casual partners, this incidence rate was 1.75 per 100 PY (95% CI: 0.87 to 3.51). The incidence of PrEP initiation was higher among GBM who engaged in R-CAIC (2.46 per 100 PY; 95% CI: 1.29 to 4.67) (P trend <0.001).

Among those who reported having any condomless sex with an HIV-positive boyfriend who had a detectable viral load or was not on treatment, the PrEP incidence rate was 14.74 per 100 PY (95% CI: 28.83) (P trend <0.001).

Prevalence of Eligibility

Among the 1257 men who reported never having used PrEP at baseline, 43.7% ($n = 549$) were eligible for PrEP during the study. At baseline, 28.6% ($n = 359$) men were PrEP-eligible, 26.7% ($n = 335$) were PrEP-eligible by 6 months, 24.1% GBM ($n = 303$) by 12 months 22.8% ($n = 287$) by 18 months, and 329 ($n = 26.2\%$) by 24 months (Fig. 1).

Among men who were eligible for PrEP at baseline, 30.2% ($n = 166$) initiated PrEP during follow-up, leaving 383 PrEP-eligible men who did not initiate PrEP. The overall incidence of PrEP use among PrEP-eligible men was 19.5 per 100 PY (95% CI: 16.4 to 23.1).

Associations With Nonuse of PrEP Among Eligible Men

By definition, PrEP-eligible men had engaged in behaviors consistent with the PrEP eligibility criteria either at

TABLE 2. Incidence Rate Ratios per 100 Person-Years for PrEP Initiation (N = 1257)

Factor	Person-Years	Incidence	Incidence per 100 Person-Years	Univariate Associations						Multivariate Associations			
				95% CI		Incidence Rate Ratio	95% CI		P Trend	Incidence Rate Ratio	95% CI		P Trend
				Lower	Upper		Lower	Upper			Lower	Upper	
Year of visit									<0.001				<0.001
2015	330.25	12	3.63	2.01	6.40	1				1			
2016	821.62	66	8.03	6.31	10.22	2.21	1.20	4.07		2.06	1.08	3.90	
2017	386.34	100	25.88	21.28	31.49	7.12	3.95	12.84		7.24	3.97	13.19	
Age									0.012				
16–24	399.06	36	9.02	6.51	12.61	1							
25–29	297.15	28	9.42	6.51	13.65	1.04	0.66	1.66					
30–39	399.17	53	13.28	10.14	17.38	1.47	0.99	2.19					
40–84	442.83	61	13.78	10.72	17.70	1.53	1.04	2.25					
Country of birth									0.168				
Australia	1267.70	144	11.36	9.65	13.37	1							
Oceania (excl. Australia)	43.88	3	6.84	2.21	21.20	0.60	0.19	1.90					
Asia	47.95	10	20.85	11.22	38.76	1.84	1.02	3.29					
North America	36.81	2	5.43	1.35	2.17	0.48	0.12	1.91					
South/Central American	6.17	2	32.44	8.11	1.30	2.86	0.77	10.57					
Europe	83.56	13	15.56	9.03	26.8	1.37	0.81	2.33					
Middle East	4.57	1	21.86	3.08	1.55	1.92	0.41	8.96					
Africa	11.99	1	8.34	1.17	5.92	0.73	0.10	5.15					
Did not answer	35.58	2	5.62	1.17	5.92	0.49	0.13	1.87					
Ethnicity									0.711				
Anglo-Celtic	1185.60	133	11.22	119.46	13.30	1							
Aboriginal or Torres Strait Islander	30.17	4	13.26	4.98	35.33	1.18	0.51	2.75					
Others	322.44	41	12.72	9.36	17.29	1.13	0.82	1.56					
State of residence									0.027				
New South Wales and ACT	635.28	88	13.85	11.24	17.07	1							
Victoria	371.73	46	13.37	9.27	16.52	0.89	0.64	1.25					
Queensland	221.01	22	9.95	6.55	15.12	0.72	0.43	1.11					
Others	310.19	22	7.01	4.67	10.77	0.51	0.32	0.81					
Education									0.371				
Less than university educated	547.61	58	10.59	8.19	13.70	1							
University educated	990.60	120	12.11	10.13	14.49	1.14	0.85	1.54					
Employment status									0.055				
Not in employment	351.47	29	8.25	5.73	11.87	1							
Part-time employed	219.51	23	10.48	6.96	15.77	1.27	0.75	2.15					
Full-time employed	967.23	126	13.03	10.94	15.51	1.58	1.07	2.32					
Socially engaged with other gay men									<0.001				<0.001
Not at all	94.93	5	5.27	2.19	12.65	1				1			
A little	583.02	35	6.00	4.31	8.36	1.14	0.46	2.83		0.94	0.37	2.37	
Mostly	372.70	42	11.27	8.33	15.25	2.14	0.87	5.26		1.34	0.54	3.36	
Very much	487.56	96	19.69	16.12	24.05	3.74	1.57	8.92		2.12	0.86	5.20	
Methamphetamine use									<0.001				0.012
No recent use (including never used)	1323.30	126	9.52	8.00	13.34	1				1			
Recent use	214.91	52	24.20	18.44	31.75	2.54	1.90	3.40		1.50	1.10	2.05	

TABLE 2. (Continued) Incidence Rate Ratios per 100 Person-Years for PrEP Initiation (N = 1257)

Factor	Person-Years	Incidence	Incidence per 100 Person-Years	95% CI		Univariate Associations				Multivariate Associations			
				Lower	Upper	Incidence Rate Ratio	95% CI		P Trend	Incidence Rate Ratio	95% CI		P Trend
							Lower	Upper			Lower	Upper	
Reasons for party drug use										<0.001			
No recent drug use (including never used)	759.91	67	8.82	6.94	11.20	1							
Recent drug use (not for sex)	546.50	52	9.52	7.25	12.49	1.08	0.76	1.53					
Recent drug use (used to enhance sex)	231.80	59	25.45	19.72	32.85	2.89	2.10	3.94					
No. of recent sex partners										<0.001			<0.001
1 sex partner	351.83	6	1.71	0.77	3.80	1				1			
Up to 10	669.38	61	9.11	7.09	11.71	5.34	2.31	12.34		3.78	1.35	10.61	
Up to 50	317.38	85	26.78	21.65	32.13	15.70	6.86	35.97		7.91	2.75	22.73	
More than 50	18.30	9	49.18	25.59	94.53	28.84	10.99	75.68		8.03	2.40	26.87	
Group sex										<0.001			
No group sex	1109.12	79	7.12	5.71	88.80	1							
Recent group sex	429.09	99	23.07	18.95	28.10	3.24	2.45	4.29					
Sex with a casual partner										<0.001			<0.001
No casual partner	595.05	16	2.69	1.65	4.39	1				1			
No anal intercourse	181.25	14	0.77	4.57	13.04	2.87	1.42	5.82		0.81	0.36	1.84	
Consistent condom anal intercourse	276.97	19	0.69	4.38	10.75	2.55	1.32	4.92		0.96	0.44	2.09	
Insertive-only condomless anal intercourse	156.36	31	19.83	13.94	28.19	7.37	4.09	13.30		1.75	0.87	3.51	
Any receptive condomless anal intercourse	295.78	95	32.12	26.27	39.27	11.95	7.06	20.20		2.46	1.29	4.67	
Did not answer	32.80	3	9.15	2.95	28.37	3.40	1.00	11.58		1.38	0.35	5.41	
Sex with fuckbuddies										<0.001			
No fuckbuddies	1177.97	91	7.73	6.29	9.49	1							
No anal intercourse	47.88	3	6.27	2.02	19.43	0.81	0.26	2.51					
Consistent condom use	69.31	7	10.10	4.81	21.18	1.01	0.62	2.74					
Insertive-only condomless anal intercourse	69.46	15	21.60	13.02	35.82	2.80	1.71	4.57					
Any receptive condomless anal intercourse	167.04	60	35.92	27.89	4.63	4.65	3.43	6.29					
Did not answer	6.55	2	30.54	7.64	1.22	3.95	1.14	13.71					
Sex with boyfriend										<0.001			<0.001
No boyfriend	733.30	96	13.09	10.72	16.00	1				1			
No anal intercourse	77.49	4	5.16	1.94	13.75	0.39	0.15	1.03		0.77	0.33	1.81	
Consistent condom use	104.71	3	2.87	0.92	8.89	0.22	0.07	0.68		0.32	0.12	1.22	

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TABLE 2. (Continued) Incidence Rate Ratios per 100 Person-Years for PrEP Initiation (N = 1257)

Factor	Person-Years	Incidence	Incidence per 100 Person-Years	95% CI		Univariate Associations				Multivariate Associations			
				Lower	Upper	Incidence Rate Ratio	95% CI		P Trend	Incidence Rate Ratio	95% CI		P Trend
							Lower	Upper			Lower	Upper	
Any condomless anal intercourse with an HIV-negative partner or an HIV-positive partner with an unknown, undetectable serostatus, or is on treatment	619.05	74	11.95	9.52	15.01	0.91	0.68	1.22		1.31	0.97	1.76	
Any condomless sex with an HIV-positive partner (detectable or not on treatment)	1.13	1	88.60	12.48	628.97	6.76	3.87	11.81		14.74	7.53	28.86	
Did not answer	2.53	0	—	—	—	—	—	—		—	—	—	

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baseline or during follow-up. However, they did not report these behaviors during every follow-up period, and those who did not initiate PrEP were less likely to report these behaviors consistently between survey visits than those who did initiate PrEP. Hence, PrEP-eligible men who did not initiate PrEP were less likely to consistently report either R-CAIC or CAI with an HIV-positive regular partner who had a detectable viral load or was not on treatment between survey rounds. They were also less likely to have engaged in other HIV risk behaviors such as use of drugs for sex or group sex during each follow-up period. PrEP-eligible men who did not initiate PrEP reported fewer sexual partners compared with men who initiated PrEP (Table 3).

In multivariate analysis among PrEP-eligible men, those who did not initiate PrEP were less likely to report a study visit in recent years. PrEP initiation in 2016 decreased from aOR: 0.08 (95% CI: 0.63 to 0.02) to aOR: 0.02 (95% CI: 0.00 to 0.18) in 2017 (P trend < 0.001).

PrEP initiation was less likely among men living in an Australian state that had not commenced a PrEP trial before 2017 (aOR: 2.11; 95% CI: 1.16 to 3.85) and who were less socially engaged with other gay men (aOR: 0.78; 95% CI: 0.68 to 0.91). Men who did not initiate PrEP were also less likely to have used drugs to enhance sexual pleasure (aOR: 0.57; 95% CI: 0.32 to 1.00). Men who were eligible for PrEP but did not initiate were less likely to report group sex (aOR: 0.59; 95% CI: 0.37 to 0.93) or any CAI (aOR: 0.20; 95% CI: 0.10 to 0.41) (P < 0.001) compared with eligible men who did initiate PrEP.

DISCUSSION

GBM in this cohort who initiated PrEP were likely to report having engaged in behaviors that corresponded with the Australian PrEP eligibility guidelines. Nonetheless, most PrEP-eligible men had not yet initiated PrEP. These men were

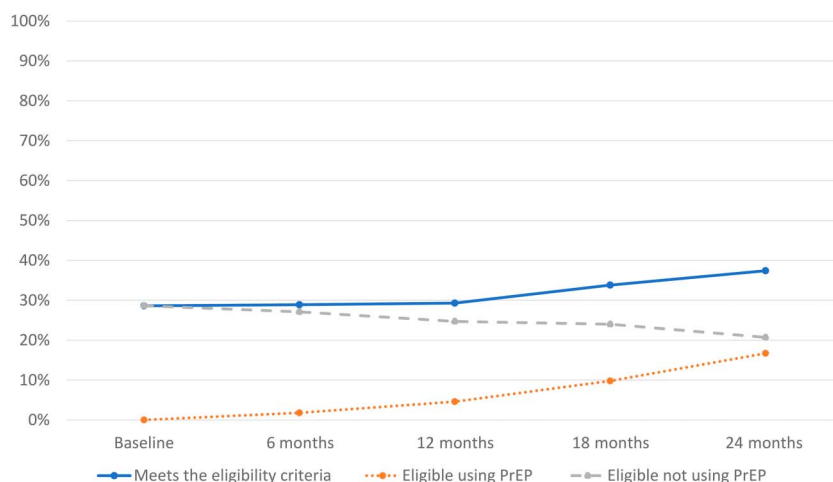
**FIGURE 1.** Prevalence of PrEP use and eligibility.

TABLE 3. Factors Associated With Noninitiation of PrEP Among Men Who Are Eligible for PrEP (n = 560)

Factor	OR	95% CI		P	aOR	95% CI		P
		Lower	Upper			Lower	Upper	
Year of visit								
2015	1				1			
2016	0.09	0.01	0.66	0.019	0.08	0.01	0.63	0.016
2017	0.03	0.00	0.24	0.001	0.02	0.00	0.18	<0.001
Age								
16–24	1				1			
25–29	0.45	0.26	0.78	0.005	0.54	0.28	1.03	0.062
30–39	0.48	0.28	0.84	0.010	0.44	0.23	0.83	0.012
40–84	0.39	0.23	0.67	0.001	0.60	0.32	1.13	0.115
Country of birth								
Australia	1							
Oceania (excl. Australia)	2.54	0.74	8.77	0.140				
Asia	0.34	0.13	0.88	0.026				
North America	1.48	0.30	7.23	0.626				
South/Central American	—	—	—	—				
Europe	0.70	0.35	1.39	0.306				
Middle East	1.69	0.19	15.30	0.638				
Africa	4.24	0.54	33.42	0.171				
Ethnicity								
Anglo-Celtic	1							
Aboriginal or Torres Strait Islander	0.73	0.17	3.11	0.674				
Others	1.13	0.71	1.80	0.609				
State of residence								
New South Wales and ACT	1				1			
Victoria	1.49	0.96	2.33	0.077	1.30	0.77	2.19	0.331
Queensland	1.78	0.97	3.29	0.064	1.30	0.65	2.62	0.463
Others	2.20	1.30	3.73	0.003	2.11	1.16	3.85	0.014
Education								
Less than university educated	1							
University educated	0.67	0.46	0.98	0.038				
Employment status								
Not in employment	1							
Part-time employed	1.35	0.67	2.74	0.401				
Full-time employed	0.82	0.52	1.30	0.406				
Socially engaged with other gay men	0.71	0.63	0.81	<0.001	0.78	0.68	0.91	0.001
Methamphetamine use								
No recent use (including never used)	1							
Recent use	1.12	0.76	1.63	0.570				
Reasons for party drug use								
No recent drug use (including never used)	1				1			
Recent drug use (not for sex)	0.47	0.29	0.77	0.003	0.37	0.21	0.64	<0.001
Recent drug use (used to enhance sex)	0.48	0.30	0.78	0.003	0.57	0.32	1.00	0.049
No. of recent sex partners								
1 sex partner	1							
Up to 10	0.28	0.12	0.68	0.005				
Up to 50	0.13	0.05	0.32	0.000				
More than 50	0.09	0.03	0.26	<0.001				
Group sex								
No group sex	1				1			
Recent group sex	0.35	0.24	0.51	<0.001	0.59	0.37	0.93	0.025
Sex with a casual partner								
No casual partner	1				1			

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TABLE 3. (Continued) Factors Associated With Noninitiation of PrEP Among Men Who Are Eligible for PrEP (n = 560)

Factor	OR	95% CI		P	aOR	95% CI		P
		Lower	Upper			Lower	Upper	
No anal intercourse	0.28	0.12	0.65	0.003	0.45	0.18	1.14	0.092
Consistent condom use	0.46	0.20	1.04	0.063	0.51	0.21	1.25	0.143
Insertive-only condomless anal intercourse	0.17	0.08	0.37	<0.001	0.21	0.09	0.51	0.001
Any receptive condomless anal intercourse	0.15	0.08	0.27	<0.001	0.20	0.10	0.41	0.000
Did not answer	0.19	0.05	0.74	0.017	0.14	0.03	0.63	0.011
Sex with fuckbuddies								
No fuckbuddies	1							
No anal intercourse	1.20	0.42	3.39	0.731				
Consistent condom anal intercourse	1.47	0.58	3.72	0.421				
Insertive-only condomless anal intercourse	1.09	0.44	2.66	0.857				
Any receptive condomless anal intercourse	0.68	0.44	1.03	0.070				
Did not answer	0.53	0.12	2.43	0.416				
Sex with boyfriend								
No boyfriend	1							
No anal intercourse	1.20	0.42	3.39	0.731				
Consistent condom use	1.47	0.58	3.72	0.421				
Any condomless sex with an HIV-negative partner or an HIV-positive partner with an unknown, undetectable serostatus, or is on treatment	1.09	0.44	2.66	0.857				
Any condomless sex with an HIV-positive partner (detectable or not on treatment)	0.68	0.44	1.03	0.070				
Did not answer	0.53	0.12	2.43	0.416				

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younger than those who initiated PrEP and tended to be less socially connected to other gay men. They also lived in states where PrEP trials had not commenced before 2017. However, many eligible men who did not initiate PrEP did not consistently engage in behaviors corresponding to the eligibility criteria over time and seemed to do so less often compared with eligible men who initiated PrEP.

The rapid rate of PrEP initiation in this sample mirrors the increasing prevalence of PrEP use found in Australian behavioral surveillance among GBM,¹⁶ coinciding with the roll-out of large-scale PrEP implementation projects throughout Australia.^{7–9} The Flux Study commenced before PrEP was listed for national subsidy and before the commencement of any of the large-scale Australian PrEP studies. Flux was neither a PrEP demonstration project nor it focused on PrEP use. Accessing PrEP was therefore not a condition for participation in this study, so participant characteristics may be more likely to reflect GBM living in Australia more broadly—a mix of PrEP users and nonusers, with varying eligibility for PrEP.

In recent years, a growing number of PrEP implementation studies across Australia and internationally have made PrEP more accessible, with approval for national subsidy likely to further increase uptake. Unsurprisingly, PrEP initiation increased over time in our sample, and living in an Australian state where a large PrEP trial had commenced before 2017 was a predictor of initiation. Among eligible men, those who lived outside an Australian state where a large PrEP trial had commenced were less likely to initiate

PrEP compared with their PrEP-initiating counterparts. In this regard, our sample reflects the unequal access to PrEP around Australia at the time of data collection.

Regardless of these access issues, younger age was independently associated with being less likely to initiate PrEP. This is also true among eligible men who did not initiate PrEP. Younger age has often been associated with lesser engagement with health care.²³ Being younger is also associated with being less socially connected to gay community, and in our data, being more socially connected with gay men was also predictive of PrEP uptake. These data reinforce the pivotal role gay community networks have played in HIV-risk reduction throughout the epidemic facilitating access to information and reinforcing social norms.^{19,24} The Diffusion of Innovations theory suggests that innovations tend to spread more quickly through tightly bonded networks of similar people.²⁵ Gay community affiliations and social connections offer such an opportunity because they can promote PrEP as a harm-reduction strategy, particularly in the context of sexually adventurous networks of GBM.²⁶ These sorts of peer networks can be used to disseminate information and normalize new prevention technologies such as PrEP.

Behaviors previously associated with HIV infection, such as R-CAIC, using drugs to enhance sex (“chemsex”), group sex, and higher numbers of partners,^{13,19,27–29} were also associated with PrEP initiation. Among eligible men who did not initiate PrEP, although they had engaged in these behaviors, they did so less frequently and reported engaging in these behaviors less consistently over time. In this sample,

GBM who used methamphetamine were more likely to initiate PrEP, and among eligible men, those who did not initiate PrEP were less likely to report drug use than were those who had initiated PrEP. Elsewhere, we have found that men who engage in chemsex have increasingly introduced PrEP into their drug use regime to mitigate against the risk of HIV infection in what would otherwise be considered a high HIV risk environment.²⁶

Furthermore, GBM who reported to have more than 50 sexual partners in the previous 6-month period had an eight-fold increased likelihood of PrEP initiation compared with men who reported fewer partners. Although the number of sexual partners was not independently associated with PrEP initiation among PrEP-eligible men, those who did not use PrEP were nonetheless less likely to have engaged in group sex and had fewer partners than did those who used PrEP. Overall, men who initiated PrEP were likely to have engaged in behaviors that met the eligibility criteria for PrEP access; however, not all men whose behaviors met these criteria subsequently initiated PrEP. Indeed, many men who reported having engaged in these behaviors did not do so either as consistently or at the same rates as the men who did initiate PrEP. For some of these men, their decision not to initiate PrEP may be based on a reasonable assessment of their current risk profile. For others, however, it may reflect misconceptions about the levels of risk required to make use of PrEP worthwhile. Although the Australian National PrEP Prescribing Guidelines determine eligibility based on reported risk behaviors, they do not report the frequency of these risk behaviors. However, our data indicate that some high-risk men were engaging in these behaviors less often or inconsistently, thereby raising concerns about the sensitivity of the National PrEP prescribing guidelines and their potential accuracy. The guidelines may need a more nuanced approach to the application of the criteria. In some cases, it may be that some men underestimate their level of risk, but it may also be that the use of a single episode of risk behavior as indicative of eligibility for PrEP may be an overestimation of their likelihood of engaging in risk behaviors on an ongoing basis. Nonetheless, it seems that lack of intimate partner knowledge is a key facilitator in HIV seroconversion,²⁸ and thus, even oneoff events can pose HIV transmission risk that might otherwise be protected by PrEP.

Limitations and Strengths

As a voluntary online convenience sample, this sample may not be representative of all GBM living in Australia. Nonetheless, those who participated in our study were similar to other samples of Australian GBM. Inherent in all self-report data, recall bias and social desirability bias may be evident.^{16,22} Our automated online methodology, however, can reduce social desirability bias in reporting illegal or stigmatized behaviors.^{30,31}

Recent findings suggest that stigma, belief, and self-efficacy are important considerations for PrEP initiation.³² Further research exploring men's reasoning for use and nonuse of PrEP is needed.

CONCLUSIONS

Most GBM who initiated PrEP in this study met the Australian behavioral eligibility criteria before PrEP initiation. However, not all men who met these eligibility criteria engaged in those behaviors as consistently as others. Although some men were eligible on previous rounds, their risk behaviors and eligibility status did not remain consistent over time compared with those who remained eligible. Furthermore, despite meeting the formal eligibility criteria for PrEP, men who did not initiate PrEP were less socially connected to other gay men. Their perception of their own level of risk compared with other gay men, and their relative lack of social connection, may influence their decisions about the need to use PrEP.

Men who are more or less socially engaged with gay community may also hold differing perceptions of social norms about or perceived acceptability of PrEP, as well as differing understandings of the level of risk required to warrant use of PrEP. Representations of PrEP users as sexually irresponsible, such as through the concept of "Truvada whores,"³³ may reinforce misconceptions about when PrEP use is appropriate and mitigate against more complete coverage in at-risk populations. On the other hand, the consistency and frequency of engaging in behaviors that correspond to the eligibility criteria varies over time, suggesting that the application of PrEP eligibility guidelines may need greater nuance than has been the case.

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